



## Wood for bees, which interactions?

Anna Dupleix

### ► To cite this version:

| Anna Dupleix. Wood for bees, which interactions?. Master. Iran. 2018. cel-02010186

**HAL Id: cel-02010186**

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Submitted on 19 Mar 2019

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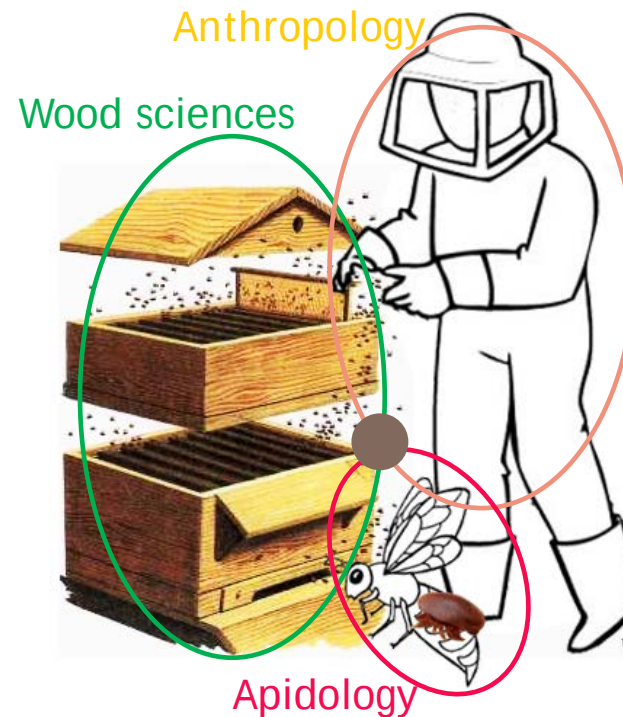
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# Wood for bees, which interactions?



Laboratoire de Mécanique et Génie Civil

Montpellier, France



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# Researcher background

- ▶ Engineer
- ▶ Master degree in Wood Technology
- ▶ Master of research in Timber design

**Topic : Investigation on failure modes of multiple-nailed steel-to-timber connections loaded parallel to the grain**

- ▶ PhD degree in Wood mechanics

International co-tutelle agreement between Arts et Métiers ParisTech LaBoMaP, Cluny, France and Aalto University, Helsinki, Finland

**Topic : Feasibility of wood peeling assisted by infrared**



# Master thesis : Investigating failure modes of multiple-nailed steel-to-timber connections loaded parallel to the grain

Case study : Radiata Pine (*Pinus Radiata*)

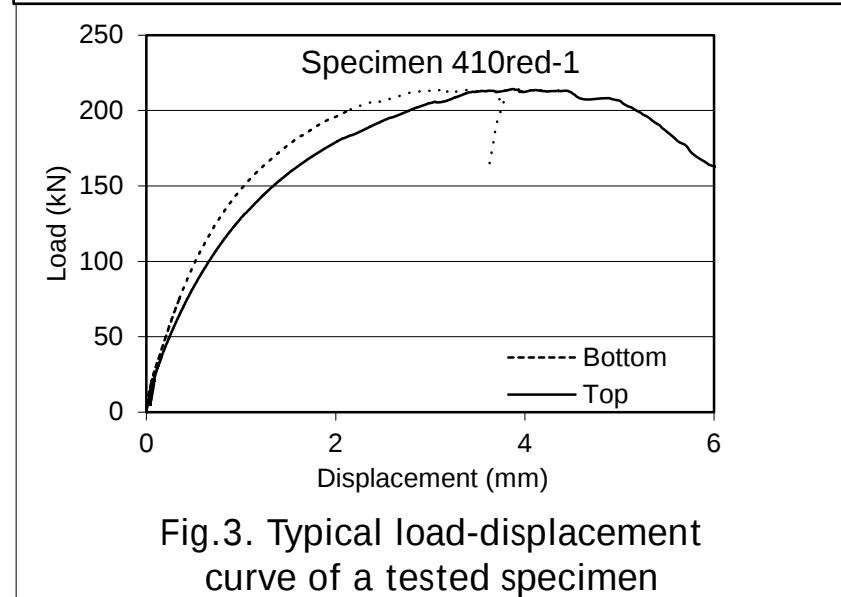
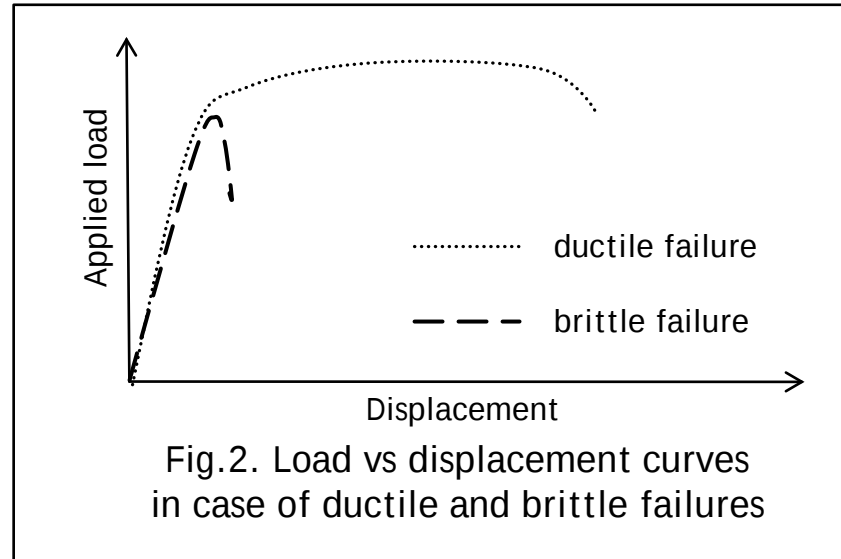


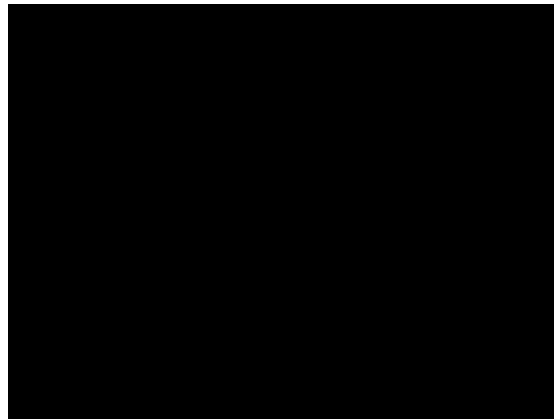
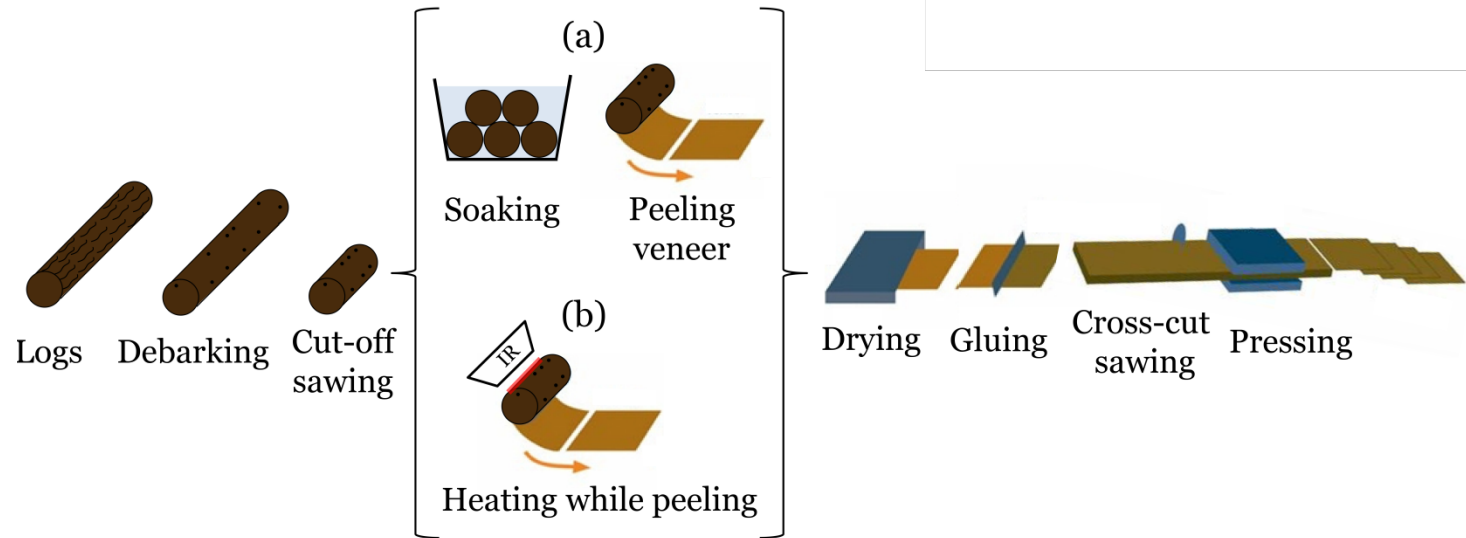
Fig.1. Test set-up

Credits : Anna Dupleix

# PhD thesis : Feasibility of wood peeling assisted by infrared radiation

## ► Peeling process: veneer production

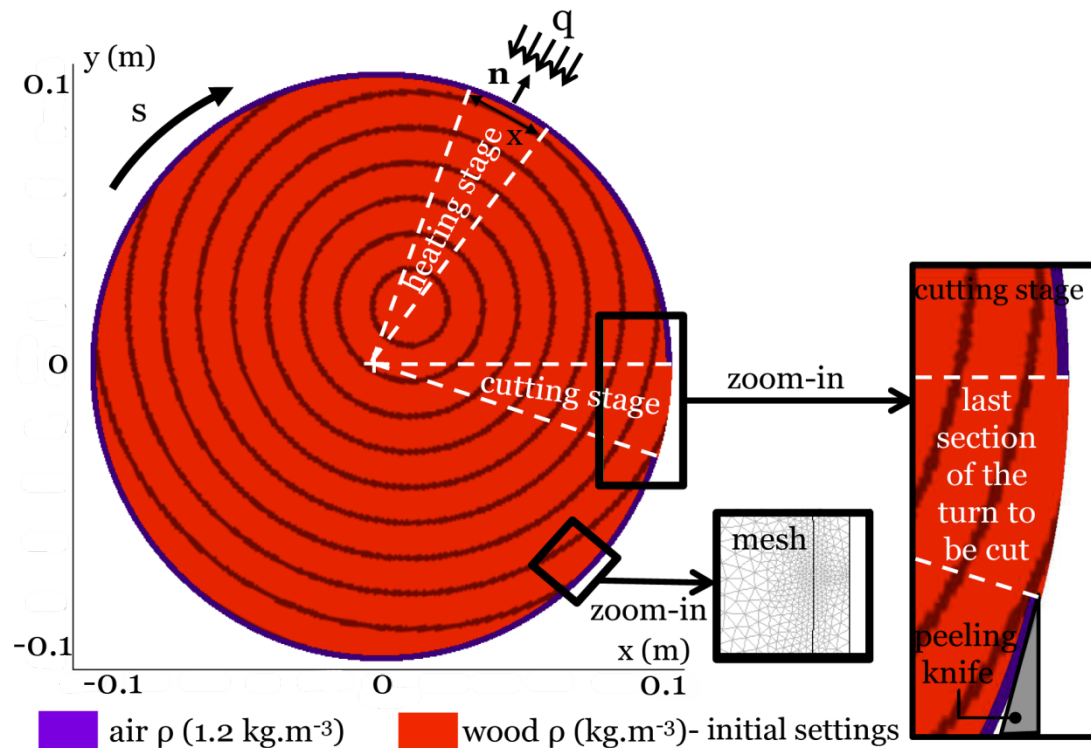
Credits : Anna Duplex



# PhD thesis : Wood kebab

- ▶ Wood is not penetrated deep and fast enough by the IR radiation

Credits : Anna Duplex

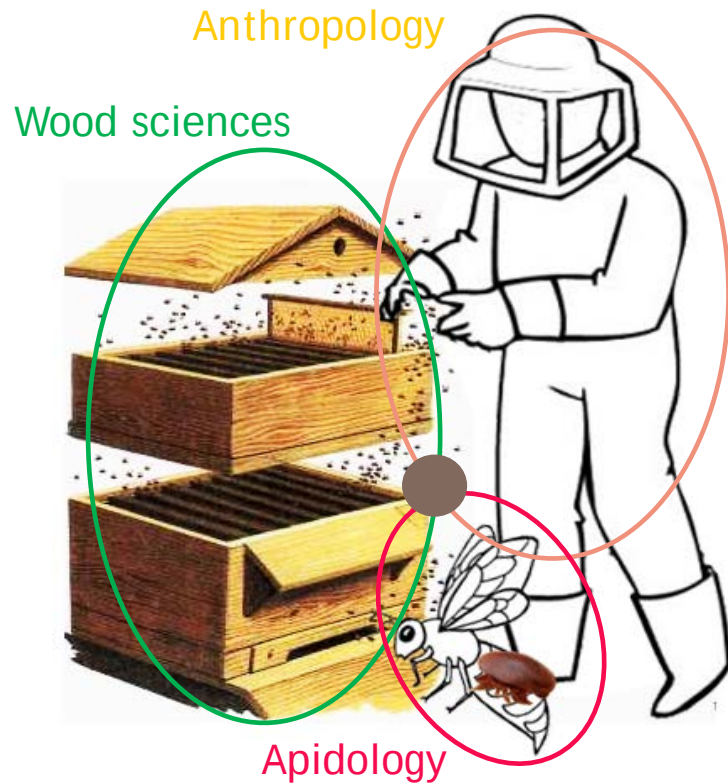


# Laboratory



Laboratoire de Mécanique et Génie Civil

- Biomechanics and wood formation
- Wood building
- Diversity of wood properties
- Uses of wood in traditional knowledge



Montpellier, France

# Project : Wood for bees, which interactions?

- ▶ Honeybees have to face major problems nowadays (pesticides, *Varroa destructor*, climate change, etc.)
- ▶ Their lives are at stake and therefore humanity because of their role in pollination
- ▶ Our hypothesis is that the wood material of the hives can help them thanks to many interactions.



Source : CNRS



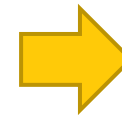
Source : pinterest.fr



Source : omafra.gov.on.ca



Source : pinterest.fr



Source : omafra.gov.on.ca

# History of the project

- ▶ Traditional uses of beehives
  - In Cévennes (South of France) : chestnut trunk
  - In Finland : polystyren



# Hypothesis of the project and methods of work

- ▶ Scientific hypothesis from local traditional knowledge

- 1) « Chestnut trunk beehives can lower temperature and humidity differences thanks to thickness of wood »
- 2) « Polystyrene beehive is more insulative from a thermal point of view »
- 3) « Chestnut extractives promote bees health »
- 4) « Chestnut wood is repellent to *Varroa destructor* »

- ▶ Tests on the thickness and material of beehive on (T°C, RH%) inner climate

- ▶ Tests on the effect of chestnut extractives on *Varroa destructor* and bees health

# Physical approach

- ▶ Comparison of different thicknesses and wood species on inner ( $T^{\circ}\text{C}$ , RH%) climate



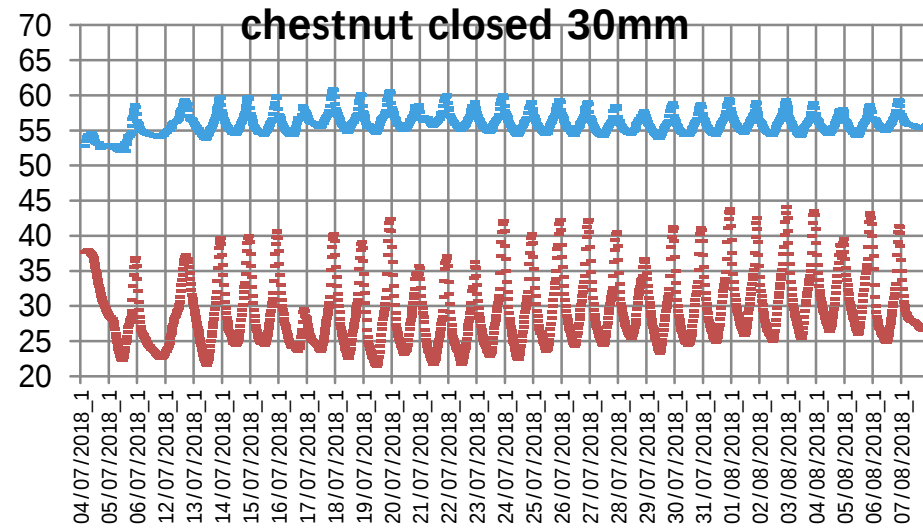
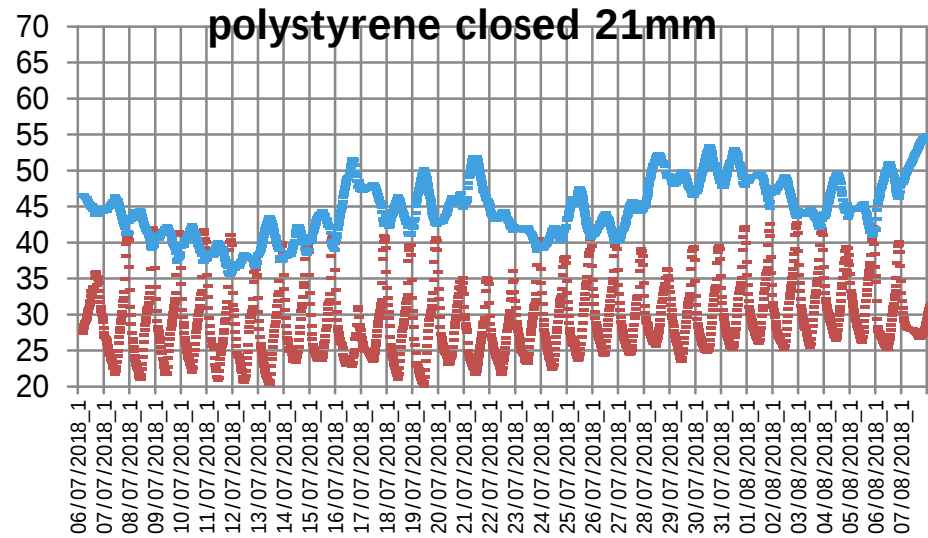
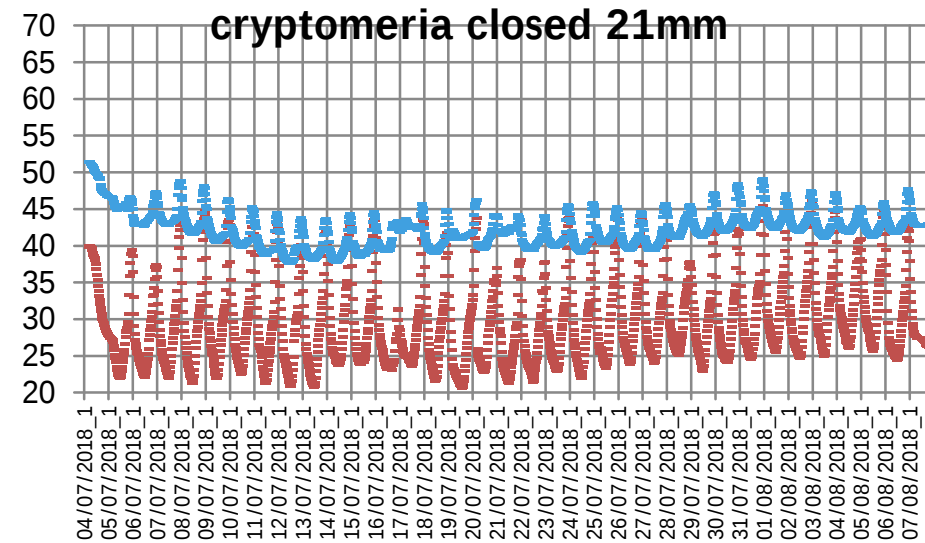
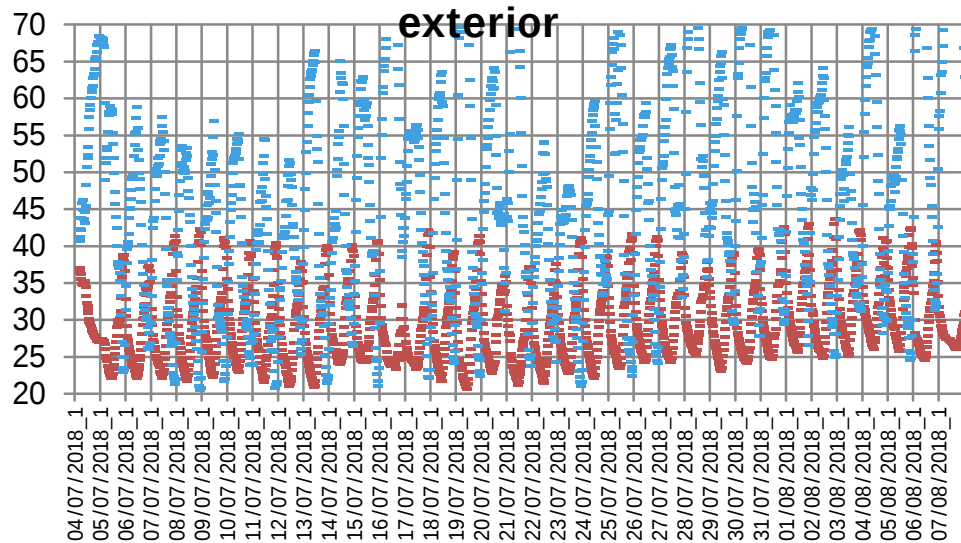
Fig. 1: Empty hives equipped with ( $T^{\circ}\text{C}$ , RH%) sensors



| Material    | Thicknesses (mm) | Open/ Closed   |
|-------------|------------------|----------------|
| Chestnut    | 15, 21, 30<br>21 | closed<br>open |
| Cryptomeria | 21               | closed         |
| Spruce      | 21<br>21         | closed<br>open |
| Polystyrene | 21<br>21         | closed<br>open |

# First results

- Relative Humidity (%) in blue and Temperature (°C) in red



# Chemical and ecological approach

- Comparison of effects on chestnut vs spruce extractives on *Varroa destructor*



Fig. 1: Chestnut extractives extraction (in gaz and in liquid forms)



Sources : Harrington

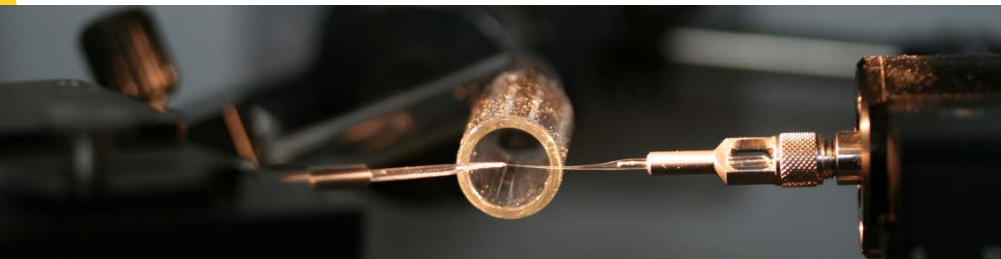


Fig. 2: Electrodes for testing olfactory sensors (located in the front leg) of *Varroa*



# Social sciences

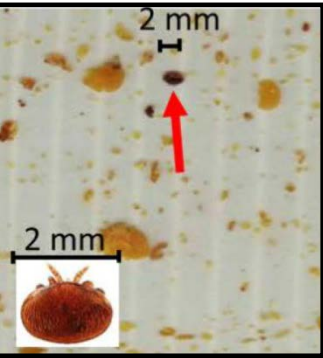
- ▶ Face to face interviews with beekeepers and beehive builders on their knowledge and perception of the wood material for the bees
- ▶ Beekeepers and beehive builders have strong knowledge on the wood material (species, properties)
- ▶ They know how to use it
- ▶ Some of them think it has an influence on the bees health (depending on their kind of beekeeping)

# Development of Varroa counting



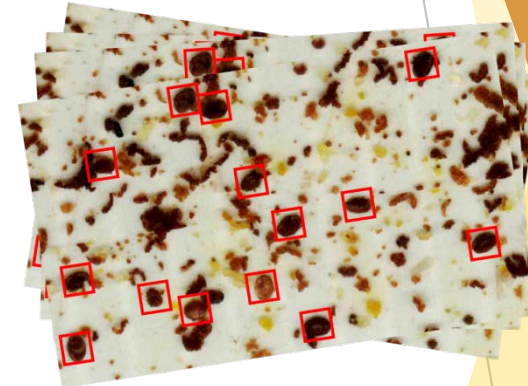
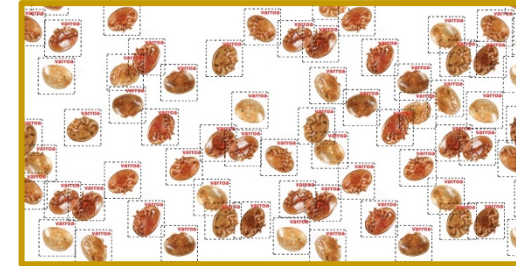
# From manual to automated counting

Today



Time-consuming

Tomorrow



Algorithms based on deep-learning

Smartphone  
Application

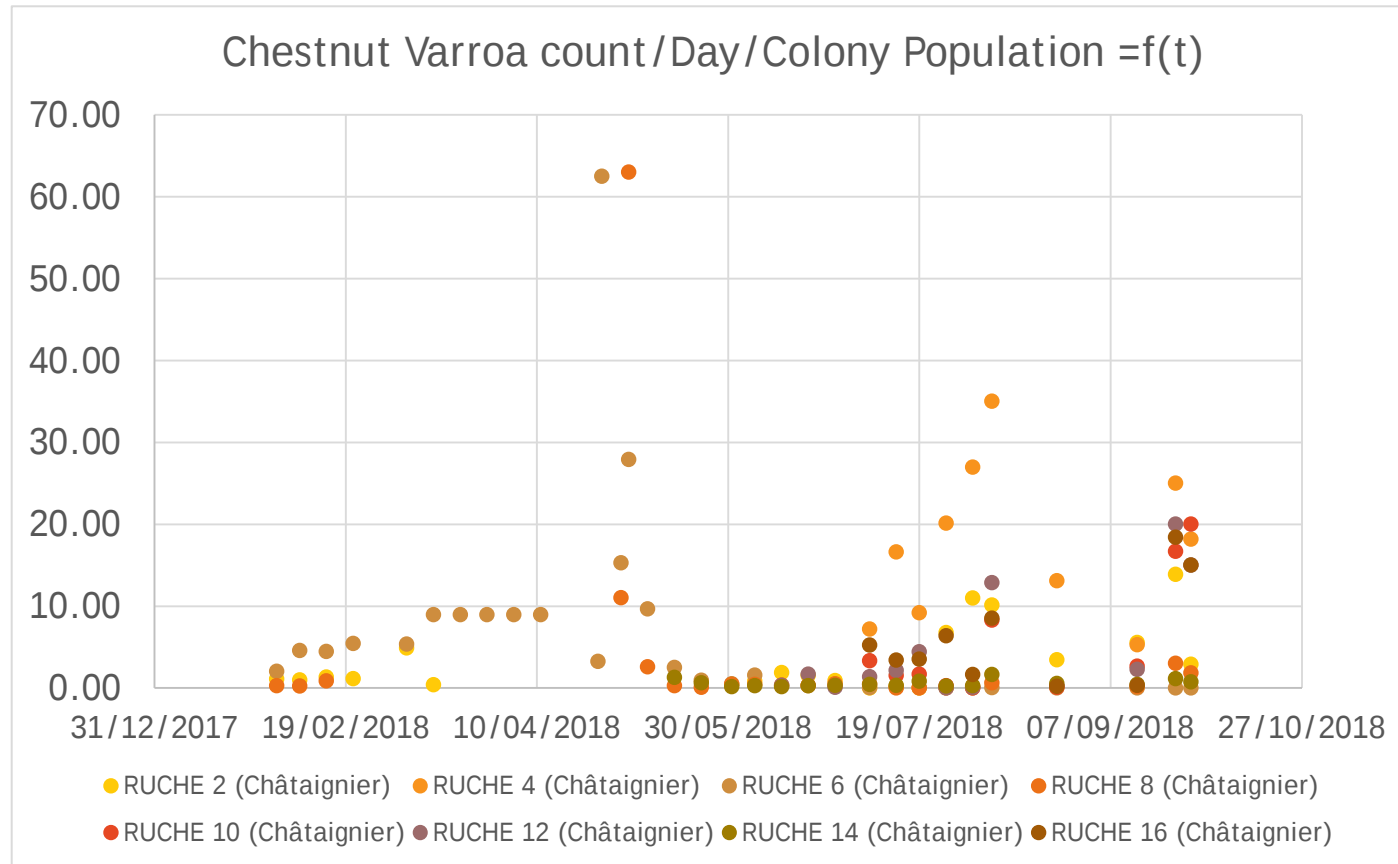


Fotonower

Connecthive

SATT  
Réseau  
des Sociétés d'Accélération  
du Transfert de Technologies

# First results of counting



# Future work

- ▶ Study ( $T^{\circ}\text{C}$ , RH%) inside living beehives (with bees)
- ▶ Comparison of effects on chestnut vs spruce extractives on bees health
- ▶ Continue this work on bee hives in living trees



Bashkyrie/Poland



Cévennes, France



**Thank you for your attention**

**and**

**Welcome to work together in  
France and Iran**

خوش آمدید به همکاری در فرانسه و ایران